



GROUNDTECH
CONSULTING




LENCH ROAD, HAREHOLME

REMEDIAL SPECIFICATION

MR JOHN HARDIE

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Plans		
<i>Plan Reference</i>	<i>Revision</i>	<i>Title</i>
GRO-20419-P01	-	Project Location Plan
2000JHP/LRR/SL01	B	Site Layout
GRO-20419-P07	-	Typical Gas Precaution Detail for CS2

1.0 INTRODUCTION

1.1 Background

This Remedial Specification has been produced on behalf of Mr John Hardie and relates to the remediation of a site at Lench Road in Hareholme.

The site was most recently occupied by horse stables and an equestrian arena. A summary of the findings of the investigations are outlined in Section 2.0.

1.2 Proposed Works

Remediation will be undertaken at the site to prepare it for development of the residential units as shown on the 'Site Layout' 2000JHP/LRR/SL01. It is proposed to construct 4 No. detached dwellings with associated detached garages and private access roads.

John Hardie has submitted a planning application which is currently under consideration by Rossendale Borough Council. This Remedial Specification has been commissioned to facilitate the discharge of any pre-commencement planning conditions that are likely to be enforced with regard to land contamination.

The Full planning permission (*PP-12481100*) is for the erection of 2 No. detached 4 bedroom dwellings, 1 No. detached 5 bedroom dwelling of two storey construction and 1 No. detached 5 bedroom dwelling of three storey construction all with private detached garages and access roads.

1.3 Objectives

The objective of this Remedial Specification is to present details of the remedial objectives, how the remediation of the site will be implemented and to outline how the works will be validated. This Remedial Specification details how the works will be permitted under the current regulatory regime.

The remediation will ensure that upon completion of the residential development, it can be demonstrated that the ground and groundwater conditions at the site are appropriate for its intended use and risks to identified receptors have been reduced to an acceptable level.

The following Remedial Specification includes the protection measures required during the enabling works phase and to be installed in the construction phase of the redevelopment for a residential end use with plant uptake.

This is a dynamic document that may require updating at certain stages of the process, the revisions should be undertaken in agreement with the relevant regulatory bodies. In addition, this Remedial Specification is subject to the approval of the regulators pre-commencement.

1.4 Remediation Specification Scope

The scope of the Remedial Specification is in accordance with LCRM is as follows:

- *Summary of the Conceptual Site Model.*
- *Summary of the Pollution Linkage Risk Assessment.*
- *Remediation Options Appraisal including detailed assessment of preferred options.*
- *Implementation of preferred remedial solution.*
- *Specification for the remediation works.*



1.5 Sources of Information

In preparing the Remedial Specification the following documents were reviewed and should be read in conjunction with this report:

- *Preliminary Risk Assessment produced by Groundtech Consulting, referenced GRO-20419-2085 dated February 2021.*
- *Geo-Environmental Appraisal produced by Groundtech Consulting, referenced GRO-20419-4660 dated August 2023.*
- *Permanent Ground Gas Risk Assessment produced by Groundtech Consulting, referenced GRO-20419-4889 dated November 2023.*

2.0 CONCEPTUAL SITE MODEL

2.1 Site Details

The site is irregular in shape and approximately 0.57 hectares in area. The topography of the site slopes steeply downwards from the south western boundary to the north east of the site. The south west of the site is approximately 8m higher than the lowest point of the site. A level platform is present in the eastern area of the site which has been cut into the slope. The platform on site is occupied by wooden stables and a rectangular equestrian centre. A circa 3m high retaining wall surrounds the stables and paddock.

A small watercourse was observed along the site's south eastern boundary which appeared to be partially culverted with stone flags

2.2 Site History and Consultations

The earliest maps show that the site was developed with a railway line and sidings which crossed the east of the site within a cutting, this was dismantled by the 1970s. The site was occupied with stables by the 2020s.

From the earliest mapping the area around the site was predominantly industrial in nature, large redevelopment of the area has occurred at all points in time around the site including both residential and commercial properties. An unspecified works is present 30m north of the site.

The Contaminated Land Officer (CLO) stated that there are no landfills within 250m.

2.3 Geology and Hydrogeology

The BGS maps do not indicate any Made Ground to be present beneath the site. The superficial deposits are indicated to be Glacial Till (Secondary Undifferentiated Aquifer) comprising clay with sand, silt and gravels. The solid geology is indicated to comprise of The Marsden Formation (Secondary A Aquifer) which comprises fine to very coarse grained pebbly feldspathic sandstone, interbedded with grey siltstone and mudstone with subordinate marine black shales, thin coals and seatearths.

BGS records indicate the Made Ground beneath the site could be 4.0m to 5.5m bgl. The superficial deposits are specified as the Shirdley Hill Sand (Secondary A Aquifer) comprising very loose to loose Sand between 0.5m and 2m in thickness, overlying Glacial Till (Undifferentiated Secondary Aquifer) of 0.25m to 6.0m in thickness. The solid geology is the Sellafield Sandstone Member (Principal Aquifer) between 4.25m and 10m/15m bgl on site.

The site is not within a Source Protection Zone and there are no groundwater abstraction licences in the vicinity of the site. Based on available records groundwater is estimated to be at 8m AOD.

The BGS 1:50,000 geological map also indicates that Landslide deposits are present on site. These are described in the Groundsure report as primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. Minor back scarring was observed on the site in the vicinity of the landslide deposits.

2.4 Preliminary Conceptual Site Model

The following risks were determined by Groundtech Consulting:

Receptor	Level of Risk
Aquifers	Low
Surface Waters	Low
Site End Users	Moderate
Ground Gas	Moderate

2.5 Ground Model

Scope

The following scope of works was undertaken on the dates of 25th May and 26th May 2023 and the 15th of June 2023:

- 11 No. windowless sample boreholes were drilled to a maximum depth of between 2.4m and 5.0m bgl.
- 10 No trial pits were excavated a depths of between 1.5m and 3.0m bgl.
- 2 No. soil percolation tests were carried out in TP05 and TP06.

Surfacing

Surfacing of the site generally comprised Topsoil from ground level to 0.3m bgl. Rubber chippings overlying a light brown fine sand was present in WS04, WS07, WS10, WS11, TP05 and TP08 to a maximum depth of 0.2m bgl. Locally, brown sandy gravel of limestone was encountered in WS06 to 0.3m bgl.

Made Ground

Made Ground was encountered across the site to a maximum depth of 3.2m bgl. The eastern and north eastern parts of the site generally encountered deeper Made Ground, in excess of 2.0m, compared to the rest of the site. The Made Ground generally comprised brown slightly gravelly clayey sand, grey sandy gravel of limestone, ash and sandstone and soft to firm slightly gravelly occasionally sandy clay.

Natural Strata

Natural strata typically comprised firm brown grey slightly sandy slightly gravelly Clay from minimum depths of 0.5m to 4.5m bgl and medium dense orange brown gravelly Sand from 1.2m to 2.2m bgl.

Locally, in the south east of the site, soft dark brown slightly gravelly slightly sandy Clay was encountered from 2.1m to 3.0m bgl. This is assumed to be associated with the watercourse adjacent to the site.

Bedrock

Weak grey and dark grey orange brown extremely weak residually weathered Mudstone recovered as a clayey gravel or gravelly clay was encountered in WS02 to WS08, WS10 and WS11 between the depths of 1.5m and 5.0m bgl.

The bedrock was encountered at a shallower depth in the west (WS06) at 1.5m bgl and was deepest in the eastern areas at depths between 4.0m and 4.9m bgl. Therefore, it appears that the Mudstone bedrock dips to from west to east.

Groundwater

No groundwater was encountered during the Ground Investigation.

Visual and Olfactory Contamination

Ash was identified within the granular Made Ground of TP05, TP06 and WS04 to WS06.

2.6 Geo-Environmental Testing Results

Groundtech Consulting scheduled the following suite of testing:

- 6 No. Heavy Metals and Speciated Polycyclic Aromatic Hydrocarbons (PAHs)
- 6 No. Asbestos Screening

Metals

All heavy metals were recorded at concentrations below the screening value for residential end use with plant uptake.

Speciated PAHs

All speciated PAHs were recorded at concentrations below the relevant screening values.

Asbestos

No asbestos was identified in the samples screening through laboratory testing.

2.7 Ground Gas

Methane has been detected at a maximum concentration of 9.9%v/v and a maximum concentration of carbon dioxide of 14.9% v/v has been recorded over the monitoring period.

Based on the GSV for both carbon dioxide and methane, the site falls within the green traffic light zone. However, due to the high concentrations of methane and carbon dioxide encountered above the respective threshold values of 5.0% v/v for methane and 10.0%v/v for carbon dioxide the classification has been increased to Amber 1/CS2 based on the levels recorded.

Radon

The latest radon maps published by UKHSA indicate that the maximum radon potential at the site is 5 to 10% and the properties potentially require basic radon precautions. It is recommended that a site-specific radon search is carried out through the BGS to confirm the exact level of precautions required for the proposed development.

2.8 Remedial Strategy

Soils

Based on the results of the investigation, no specific remedial measures are required with respect to contaminated soils. No elevated Contaminants of Concern have been recorded within the samples tested and no asbestos has been detected in any of the samples screened.

It should be ensured that topsoil and subsoil used within the proposed garden areas are suitably clean for the proposed residential end use.

Controlled Waters

No mobile contamination has been encountered and therefore remediation with respect to controlled waters will not be required.

Ground Gas

Based on the Ground Gas monitoring results, the site falls within the CS2/Amber 1 classification and gas protection measures will be required for the proposed development. 3.5 points of protection are required for the proposed residential development and gas protection measures are necessary.

The site also lies in an area where basic radon measures may be required prior to completing a site specific radon search. The installation of CS2 gas resistant membranes will be sufficient to reduce the risk of Radon at the site. The specification of the selected membrane for the site should be evaluated to confirm it will reduce the risk of Radon.

2.9 Geotechnical

Foundations

Traditional strip/trench fill foundations may be adopted for Plot 1 and Plot 2 in the west of the development area constructed within the natural medium dense gravelly Sand or the medium to high strength Clay deposits at a minimum depth of 0.75m bgl. Foundations should be deepened through all Made Ground deposits.

The most suitable foundation solution for Plots 3 and 4 in the western part of the site is considered to be mini piles due to the deep Made Ground encountered across this part of the development area. If it is more cost effective, this foundation solution could be adopted for the whole site.

Slope Stability

A slope stability risk assessment is required in order to assess the stability of the slope located in the north eastern corner of the site. This will inform any stabilization methods required to support the proposed residential development and prevent failure.

Concrete

The results of laboratory pH and sulphate content indicate that ACEC Class AC-2z and sulphate class DS-1 conditions prevail in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005.

Pavement Design

CBR values of 2% to 3% are likely to be achieved in undisturbed natural soils for pavement design purposes, unless proven otherwise by in-situ testing at sub-base level. Untreated Made Ground should be assumed to have a CBR value of less than 2.5%, unless proven otherwise.

SuDS

The use of SuDS drainage within the natural ground is not considered feasible as testing has demonstrated poor soil infiltration rates which are not considered favourable for SuDS drainage.

3.0 POLLUTION LINKAGE ASSESSMENT REVIEW

The following section summarises the revised pollution linkage assessment undertaken by Groundtech Consulting Limited.

3.1 Human Health

Receptor	Level of Risk	Comments
Site End Users	Low	No elevated CoC identified during the Ground Investigation
Site End Users (Asbestos)	Low	No asbestos was identified through laboratory screening
Site End Users (Ground Gas)	Moderate	Site has been classified as CS2/Amber 1 due to concentrations of carbon dioxide and methane
Adjacent Residents	Low	No mobile contamination identified

3.2 Controlled Waters

Receptor	Level of Risk	Comments
River Irwell and unnamed watercourse	Low	No mobile contamination identified
Secondary A Bedrock Aquifer	Low	Glacial Till beneath the site limits downward migration and no contamination identified by the Ground Investigation

3.3 Groundworkers

Receptor	Level of Risk	Comments
Contractors	Low	No contamination identified

4.0 REMEDIATION PROPOSALS AND APPRAISAL

Remediation will be undertaken to ensure the site is suitable for its proposed residential end use which comprises the construction of 4 No. detached dwellings with associated private access and garages.

The required level of remediation, to the satisfaction of the relevant regulators and discharge planning conditions, will be accomplished through a combination of techniques as outlined in the subsequent sections.

The implementation of the remediation proposals will be in accordance with the following documented quality assurance procedures:

1. **Detailed Remediation Specification** which outlines the requirements to demonstrate the effectiveness of the remediation in order to meet the remediation objectives. These are detailed in the following sections of this report.
2. **Verification Report** which will provide a complete record of the remediation activities undertaken during the enabling phase and construction phase to support compliance with remediation objectives and criteria. The report will also contain descriptions of the works including photographic evidence and details of any unexpected conditions encountered during the remedial works and how they were dealt with.

In addition to the above, the preferred contractor will be required to secure all necessary permits and licences to allow remediation to be undertaken and prepare appropriate health and safety risk assessments and method statements in accordance with CDM Regulations 2015 and other relevant legislation.

4.1 Outline Remediation Proposals

Based upon the findings of the Ground Investigations, risk assessment and the remediation options appraisal in accordance with LCRM, the following remediation processes will be carried out to produce a site which is suitable for its proposed residential end use and adhere with the General Requirements set out in *Appendix 2*.

The following remediation activities have been selected based on the Remedial Options Appraisal presented in *Appendix 3*:

- *Vegetation clearance and Topsoil strip including testing for re-use*
- *Demolition of existing structures and break out of all below ground substructure*
- *Watching brief for previously unidentified contamination*
- *Placement of 300mm of 6F2 as piling mat*
- *Off-site disposal of unsuitable or excess material*
- *Excavations for foundations*
- *Excavations for service runs and drainage*
- *Installation of correct level potable water supply pipe*
- *Placement of clean validated subsoil/topsoil in areas of gardens and soft landscaping*
- *Installation of approved ground gas protection measures within the building foundations*

4.2 Project Setup and Management

Prior to commencement of site activities, detailed planning of the project shall be undertaken including liaison with the client, supervising consultant, contractors and regulators. The Remedial Specification should be submitted to the relevant regulators for approval prior to commencement.



The project is to be operated under the Construction, Design and Management (CDM) Regulations, (2015).

Under the CDM regulations, the Client should appoint a Principal Designer, who will provide the Pre-construction Information Report and a Principal Contractor who would provide a comprehensive Construction Phase Health and Safety Plan (CPHASP) prior to works commencing. If the client does not appoint a Principal Designer, they will assume the role.

The Principal Designer will review the CPHASP and notify the local office of the Health and Safety Executive (HSE) of the works prior to commencing (via form F10), if necessary. The client is to nominate the Principal Contractor for each phase of works.

5.0 IMPLEMENTATION OF SITE REMEDIATION PROCESSES

5.1 General

The following remedial works are required to break pollution linkages, to reduce risks to an acceptable level and make the site suitable for the proposed residential end-use.

5.2 Implementation

Activity 1 – Pre-Start and Site Clearance including Topsoil Strip

The contractor shall be responsible for the true and proper setting-out of the works and for the correctness of the position, levels, dimensions and alignment of all parts of the works and for the provision of all necessary instruments, appliances and labour.

The contractor shall carefully protect and preserve all benchmarks, sight rails, pegs and other things used in setting out the works.

Should the works contractor find any discrepancies on the drawings, he is to refer the matter to the client for verification before proceeding with the part of the works affected.

Before starting the site clearance works, the works contractor shall verify with the client and/or architect which existing fences, gates, walls, roads, paved areas, trees, shrubs, etc., are to be removed and undertake dilapidation survey of all adjacent features/construction including but not limited to boundary walls/fences, adjacent footpaths and road constructions etc. The works contractor shall be responsible for all costs associated with rectification of damage to adjacent features/construction including but not limited to boundary walls/fences, adjacent footpaths and road constructions etc. resulting from the enabling works.

The contractor shall investigate the features of the structures, ascertain if shock or vibration could damage surrounding property or equipment therein or buried utilities and check the existence of toxic or flammable substances.

Statutory service records are for information only. The contractor is to ensure that the records are current and complete through discussion with all appropriate statutory bodies and is responsible for all disconnection, diversion, sealing or removing of existing services as necessary (unless otherwise advised by the client).

Trees, boundaries and other features of interest, which are to be retained, shall be clearly identified and protected by a robust fence to avoid accidental impact damage and prevent excavation within the root zone of influence of foundations. All works shall be undertaken in accordance with BS 5387: 1991 'Trees in relation to Construction'. All other trees and shrubs shall be grubbed up and disposed of appropriately off site.

Prior to any works, the site shall be cleared of approved vegetation. Surface vegetation shall be stripped from all areas prior to trafficking with heavy plant and the surface vegetation is to be chipped and stockpiled.

The topsoil should be stripped and stockpiled separately, the topsoil is likely to be considered suitable for reuse based on previous Geo-Environmental testing. It is recommended that once the topsoil has been stockpiled additional testing is carried out to determine whether it can be used. If it is deemed to be contaminated, it should be disposed of to a suitably licensed waste facility.

As part of the site clearance, the existing buildings on site will be demolished and either removed from site or processed for reuse. The rubber chippings which surface the current equestrian centre and stables should be



stripped and stockpiled separately prior to removing off site. The rubber materials should be disposed of to a suitable waste disposal facility.

The contractor shall maintain records detailing the approximate location of any unsuitable material disposed, including a brief description.

All movement of materials shall be recorded and records shall be kept detailing the nature and quantity of materials, haulier details, final destination and any other relevant information.

Water or liquids shall not be pumped or emptied into the existing sewers/drainage system without the appropriate treatment and written permission of the relevant authority. If mobile tankers/bowsers are to be used, then disposal shall be at suitably licensed facilities in accordance with current legislation.

Documentation/certification of all materials disposed of are to be included in the H&S file prepared by the enabling works contractor.

Activity 2 - Break out of Hardstanding and Below Ground Obstructions and Processing for Re-use

The contractor shall demolish, break up and remove all below ground structures. These include, but are not limited to slabs, drains, hardsurfacing, foundations, relic structures, utility ducts, etc.

All broken up materials shall be segregated and stockpiled within the approved working area of the site. Material shall be stockpiled at locations to be agreed with the Client and after submission of the detailed method statements.

During the excavation of slabs etc, the works contractor will maintain a watching brief, with any additional risks to be added to the remedial requirements.

The contractor shall provide adequate protection against collapse of the excavations and suitable groundwater control measures shall be put in place until the voids are backfilled to a suitable geotechnical specification.

The contractor shall ensure that any future contamination entering or leaving the site is negligible. The enabling works contractor shall state his methodology for ensuring this requirement.

All unsuitable materials are to be removed from site to a suitably licensed facility.

Activity 3 - Reuse of Soils and Placement of Soils

The requirement for placement of soils should be undertaken in accordance with this Remedial Specification.

The contractor is to undertake a watching brief for materials which may potentially be contaminated during excavations of foundations and drainage. If suspect materials are encountered, the soils are to be stockpiled separately and Groundtech Consulting contacted immediately.

Activity 4 - Off-Site Disposal of Unsuitable or Surplus Material

Any soils to be removed from site are to be removed to a licensed waste management facility and the waste is to be transported by a registered waste carrier in accordance with applicable Waste Management Regulations. Testing to allow disposal of waste is to be undertaken.

Waste consignment/transfer notices will be required and are to be retained by the contractor. Copies of all waste consignment/transfer notices are to be provided to Groundtech Consulting for inclusion in a validation report.

Accurate classification by assessment of the soils and WAC testing will provide indication of the most cost beneficial populations to dispose offsite.

Activity 5 - Watching Brief

A watching brief should be maintained for the duration of the works for visual or olfactory evidence of contamination. If identified, work should cease in that area and Groundtech Consulting consulted for advice and to revise the Remedial Specification, if required.

The Principal Contractor must manage the risks in accordance with their legal requirements and will need to prepare appropriate health and safety documentation and obtain appropriate approvals, licences, consents and permits prior to commencement.

Activity 6 - Placement of Piling Mat

Mini Piles are to be adopted for the foundations of Plots 3 and 4 due to the deep Made Ground in excess of 2.0m in the eastern and north eastern extents of the site. A piling mat is required to be designed and placed prior to foundations.

Any substructure removed during the demolition of the existing buildings on site may be crushed and re-used in the piling mat following confirmation testing to ensure it is not contaminated as per the below.

Activity 7 - Validation Criteria During Works

The following sections detail validation criteria to be used during the works.

Testing

All testing during the works shall be undertaken by the works contractor and all sampling, logging, and testing of soils shall be undertaken in accordance with BS 5930:2020 'Code of Practice for Site Investigations' and BS 10175:2011+A1:2017 'Investigation of Potentially Contaminated Sites – Code of Practice'.

The works contractor shall undertake all testing at a laboratory which holds UKAS and MCERTS accreditation for the specific tests. The Consultant shall be given sufficient time to review the content of the testing and the associated test results.

General Reuse

The following is required to allow re-use of soils:

- *No visual contamination (oil staining etc.)*
- *Minimal deleterious material (organics, wood, metal etc.)*
- *No visible Asbestos Containing material (ACM)*

The visual requirements in the list above are to be confirmed by a suitably qualified geo-environmental engineer.

Activity 8 - Installation of Correct level of Potable Water Supply Pipe

The correct potable water pipework is to be installed for all plots by the works contractor in accordance with local water company risk assessment. The works are to be validated by the ground works contractor, who is to provide to Groundtech Consulting:

- *Provision of delivery tickets showing correct potable supply pipework has been delivered to site.*
- *Photographic proof that the correct potable supply pipework (or similar) has been installed.*

Activity 9 - Importation of Suitable Material

The Topsoil on site may be suitable for reuse subject to further testing.

In addition, any imported materials are to be tested by the contractor in accordance with this Remedial Specification to demonstrate they are suitable from a geotechnical and geo-environmental engineering perspective.

Any imported soils should be from a source not expected to be contaminated and meet both physical and chemical criteria, as detailed in this Remedial Specification.

Prior to importation of topsoil, subsoil or granular material from a commercial supplier, certification should be obtained from the supplier detailing the source site, its previous and current land use and relevant test results. A copy of this should also be forwarded to Groundtech Consulting for review and comparison against the import criteria.

Imported material should be free from:

- *Asbestos, metal, plastic, wood, glass, tarmac, brick, paper, concrete, or other potentially hazardous foreign material which could cause injury.*
- *Aggressive / invasive weeds (especially Japanese Knotweed and Giant Hogweed) and bulk vegetative growth.*

If the material is not from a supplier, it is recommended that testing is undertaken at the source to determine if the materials are likely to be suitable prior to import. Geo-environmental testing will also be required once the material arrives at site to confirm the soils imported are the same as those sampled at the donor site.

For material from a natural source, testing should be undertaken at a rate of one test per 250m³, with a minimum of three tests to be undertaken on any individual source material.

If the source of the material is not natural, chemical testing should be undertaken at a rate of one test per 100m³, with a minimum of five tests to be undertaken on any individual source material.

The results of geo-environmental testing for imported material are to be compared with the criteria presented in *Appendix 4*. If any of these thresholds are exceeded the material shall be considered unsuitable unless treatment, further testing and risk assessment shows it to be satisfactory. Testing should be carried out for the following general suite of contaminants:

- *Heavy metals, total cyanide, pH, speciated Polycyclic Aromatic Hydrocarbons, total phenol, and organic matter.*
- *Speciated TPH (TPH CWG), if required.*
- *Asbestos screening.*

Imported topsoil and subsoil for the cover system should be as agreed with the client and where possible should conform to BS 3882:2015 and BS 8601:2013. It should be noted that clay soils are not recommended as they are likely to become waterlogged during handling and placement.

The Geo-Environmental test results indicate that no remediation is required with respect to contaminated soils. A minimum of 150mm suitably clean Topsoil is required in areas of soft landscaping and private gardens in the proposed development to act as a growing medium.

Activity 10 - Ground Gas and Radon Protection Measures

Based on the ground gas monitoring results, the site has been classified as CS2/Amber 1 and gas protection measures are required, comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into buildings, for the proposed development.

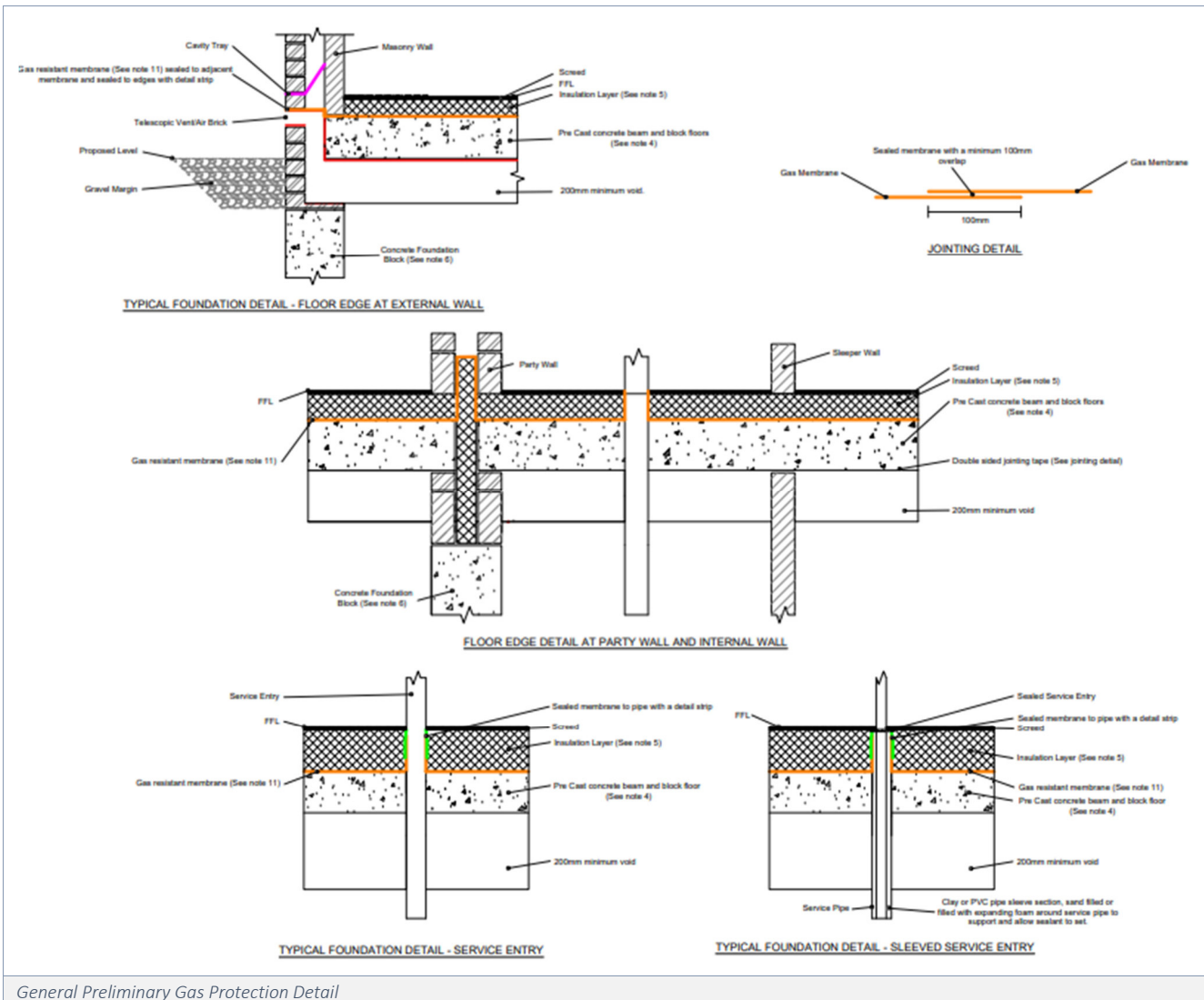
The new Radon maps published by UKHSA indicate that the site is in an area where the maximum radon potential is 5 to 10% and basic radon measures may be required in accordance with BR 211 at this stage. The installation of CS2 gas resistant membranes will be sufficient reduce the risk of Radon at the site, the specification of the selected membrane for the site should be evaluated to confirm it will reduce the risk of Radon.

The proposed residential development is classified as a Building Type A in accordance with BS 8485:2019 and the site is designated as CS2 therefore, 3.5 points of protection are required for the proposed development.

The 3.5 points can be achieved by a combination of two or more of the following three types of protection measures to achieve that score:

Protection Measure	Details	Points of Protection
Structural Barrier/Floor Slab	<i>Cast in situ monolithic reinforced ground bearing raft or reinforced cast in situ suspended floor slab with minimal penetration</i>	1.5
Ventilation Protection Measures	<i>Passive sub floor dispersal layer of good performance</i>	1.5
Gas resistant Membrane	<i>Gas resistant membrane (including methane) meeting the criteria outlined in Table 7 of BS 8485:2020</i>	2.0

As per the highlighted detail below, it is proposed that a suspended floor slab will be used for the residential development which will allow and meet the points of protection for appropriate ventilation (1.5), along with a gas resistant membrane which will provide 2.0 points. Therefore, the 3.5 points of protection will be achieved. A preliminary General Gas Detail is presented on Groundtech Consulting plan GRO-20419-P07 and an extract is below.



The ground gas protection measures are to be installed by PAGeo which are a qualified and experienced installer (minimum one operative to hold a NVQ Level 2 in gas protection installation).

The ground gas protection should be installed with all due regard to best practice and guidance.

The membrane specification is presented in *Appendix 5* for approval by Rossendale Council in advance of the development.

Validation and verification will be required to the scope agreed with the Local Authority. It is currently proposed that Geo Shield will verify and validate the installation of the CS2 gas protection measures (minimum one operative to hold a NVQ Level 2 in gas protection installation). The 'Gas Protection Validation Record' sheet is presented in *Appendix 6* and will be completed during the site visit to verify the ground gas protection measures. Due to the small scale of the development, gas protection measures will be verified on a plot-by-plot basis. A gas membrane validation report will be produced following the installation and verification.

6.0 SUPERVISION, VERIFICATION AND REPORTING

Necessary changes to the agreed Implementation Plan, arising during the course of the works, are to be agreed in writing with the Local Authority and Environment Agency prior to being undertaken on site.

It is recommended that details of the environmental works undertaken, the rationale and design for the implementation of this strategy and verification details of the works undertaken are appended to the deeds for the property to ensure the site is sold with full knowledge of the works undertaken and the ground conditions present.

6.1 Site Supervision

Remediation works are to be undertaken with a part time site watching brief by Groundtech Consulting (The Consultant).

6.2 Collection of Samples

All sampling, logging and testing of soils shall be undertaken in accordance with BS 5930:2020 'Code of Practice for Site Investigations' and BS 10175:2011+A2:2017 'Investigation of Potentially Contaminated Sites – Code of Practice'.

Soils for inorganic analysis will be sealed in air-tight polythene tubs, and soils for organic analysis will be sealed in amber glass jars with the minimal practicable headspace.

All samples shall be scheduled on chain of custody forms prior to being dispatched to the UKAS accredited laboratory for analysis.

6.3 Contractor Records

On receipt of the records from the contractor, to demonstrate that all of the works have been undertaken in accordance with the Remedial Specification, Groundtech Consulting will provide a validation report.

The report will be prepared by Groundtech Consulting and will provide a summary of the key elements of work and will be referenced to the agreed redevelopment strategy and planning requirements with supporting information presented within appendices.

This shall be based on current risk assessment guidance and specifically will include supporting information as summarised below:

- *Details of methodology and programme*
- *Records of works undertaken and associated validation/monitoring records obtained from the contractor as detailed above*
- *Final status of remediation and confirmation of remedial objectives to satisfy the planning conditions*
- *Additional risk assessments/reactive works undertaken*
- *Site stripping and clearance activities during remediation*
- *Records of excavations*
- *Records of laboratory test results*
- *Approximate quantities for all materials removed from the site*
- *Waste classification and management documentation, including copies of all consignment notes.*
- *Potable water pipe installation.*

On completion of the works validation to development level the appropriate documentation will be forwarded to the client, for forwarding to the Local Authority.

6.4 Ground Gas Verification

Ground gas mitigation measures shall be installed by the contractor in accordance with CIRIA 665. Validation of ground gas membranes will be undertaken by Groundtech Consulting in accordance with CIRIA C735 and included in the validation report.

6.6 Cover System

Verification of cover system thickness is required. Testing of imported soils will be required in accordance with this Remedial Specification. Groundtech Consulting should be notified when the cover system has been placed and will undertake a visual inspection and random spot check excavations.

If the cover system is deemed to be inadequate, the site manager will be informed and advised on remedial measures. Verification of the cover system will only be carried out where the cover system has been completed.

The cover system validation report will include:

- *Confirmation of the source of imported material*
- *Confirmation of the physical suitability of the material as per Section*
- *Confirmation that the geo-environmental test results pass when compared to the appended RTVs*

The cover system will be validated in accordance with YALPAG.

7.0 MATERIALS MANAGEMENT

7.1 On Site Material Management

Stockpiles

Site won material for potential reuse will be stored on site in stockpiles. The stockpiles are to be managed by the contractor and will be subject to operational constraints at the time of stockpiling.

Stockpile locations will be clearly marked and documented on working drawings maintained in the site office.

The contractor is to take appropriate mitigation measures and environmental precautions as considered necessary at storage locations. However, as a minimum, stockpiles should be compacted to prevent dust and they should be kept wet in periods of dry weather.

During the remediation works, materials will be excavated and consolidated into designated stockpiles, with the different soil types stockpiled in different clearly marked stockpiles. A record of the excavated quantities and reuse locations will also be maintained on site. A copy of all tracking forms and delivery tickets used for transportation of soils to site will be held at the site office.

Confirmatory Testing for Material for On Site Reuse – Excavated Material

A single topsoil sample has already been tested during the Ground Investigation, additional topsoil testing will be required to determine if it is suitable for reuse.

Materials found to be out of specification are to remain on site in segregated stockpiles until such time that they can be disposed to a suitably licenced waste disposal facility.

Confirmatory Testing for Material for Off-Site Disposal

Any material requiring disposal shall be disposed of by the contractor. They shall ensure adequate and appropriate disposal, including testing to satisfy the proposed waste facility.

Records of the removal of stockpiles off site should be maintained by the contractor including details of the disposal or treatment site to which they have been taken. These details are to be passed to Groundtech Consulting to form part of the validation report.

Appropriate precautions should be taken by the contractor to ensure that the stockpiled material does not result in risks to neighbouring land users.

Confirmatory Testing for Imported Material

Imported soil will be tested to determine it is suitable for use.

The contractor importing the material is to provide laboratory testing results to Groundtech Consulting to prove the suitability of the material to be brought on to site in line with the requirements specified in this Remedial Specification. Once the soils are present on site, additional testing will be undertaken.



8.0 CONTINGENCY PLAN AND AREAS OF UNEXPECTED CONTAMINATION

There is potential for areas of unexpected contamination to be present, due to the former use of the site. The strategy for unexpected contamination must be relayed to all site personnel during the enabling works phase and outline a clear allocation of responsibility for reporting and dealing with contamination.

Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the requirement to report this to the client and Groundtech Consulting.

A report will be prepared by Groundtech Consulting and submitted to the regulatory parties, the Local Authority and the Environment Agency where groundwater may potentially have been impacted.

If additional materials are identified, these materials will be subject to the procedures stated in this Remedial Specification.



APPENDIX 1 - Plans



 GROUNDTECH CONSULTING	CLIENT	DATE			Status	Notes  Location of Site
	JOHN HARDIE	JANUARY 2021			Preliminary	
	PROJECT TITLE	SCALE			Draft	
	LENCH ROAD, HAREHOLME	NTS			Issued <input checked="" type="radio"/>	
	PLAN TITLE	PLAN NUMBER			For Comment	
PROJECT LOCATION PLAN	GRO-20419-P01	Rev.	Details	Date	Approved	

THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE RELEVANT HOUSE TYPE DRAWINGS, FOUNDATION PLAN AND SCHEUDLE AND THE SITE SPECIFIC GROUND GAS AND GROUND INVESTIGATION REPORTS

NOTES

- Groundtech take no responsibility for the inappropriate use of this detail on a development. The drawing is specifically designed in accordance with findings and recommendations of ground gas monitoring.
- Groundtech drawing is in accordance with current guidance with respect to design of measures and specification of membranes for the adequate protection of dwellings from the ingress of harmful ground gases. The details contained on this drawing are generic and for guidance purposes only. Any proposed amendments to the detail due to variations on specific house types should be referred back to Groundtech for review and approval prior to implementation on site.
- This drawing was prepared for the purpose stated. New products, improved practices and legislation may necessitate an alteration to this drawing in whole or in part after its submission. It is recommended that this drawing is referred to Groundtech for reappraisal no later than one year from the date on this drawing. Continued use of this drawing beyond this date is at the Developers own risk.
- Refer to reinforced cast in situ suspended floor slab for relevant house types.
- Refer to insulation details on specific house type slab drawings and plot specific footing plans.
- For details of proposed foundations refer to engineers Foundation Zone Plan and Foundation schedule.
- Characteristic Situation is defined in CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'. Suitability of mitigation measures in accordance with BS8485:2015+A1:2019.
- All gas membranes should be installed to the manufacturer's guidelines and recommendations. Special care must be taken to ensure that the gas membrane is not snagged, torn, punctured, stretched or in any way damaged during construction. All damaged areas of the gas membrane must be replaced or repaired to manufacturers recommendations.
- Joints between sheets of gas membrane should be well lapped (100mm min) and taped between sheets with a jointing tape in accordance with the manufacturer's recommendations.
- All service entry points should be sealed to pipes using detailing tape from the membrane manufacturer and recommended to follow Groundtech Construction Guides. Preformed top hats do not have sufficient space for installation within being exposed above the floor slab and therefore are not recommended in this design.
- The specification for the gas resistant membrane should be confirmed by the gas risk assessor specific to the potential types of hazardous ground gas or vapours identified on the site the proposed membrane should be resistant to the identified gasses. If gas mitigation measures include requirements for designs to mitigate against vapours compliant with CIRIA C748 then alternative welded membranes and protection systems would be required, these are outside of the design parameters of this typical gas detail for Characteristic Situation 2 protection measures. It is assumed the membrane will need to comply with minimum membrane specifications from BS8485:2015+A1:2019, with verification following CIRIA C735. Where aluminium foil membranes are proposed to be constructed and would be in contact with wet concrete a membrane protection layer is required. The protection layer should overlay the gas membrane and comprise of a geotextile, non-woven, needle punched fleece with a mass per unit area of at least 300g/m². **The specification of the gas resistant membrane should be submitted to the gas risk consultant and verifiers for approval.**
- Installations to be installed by a verified and accredited contractor.

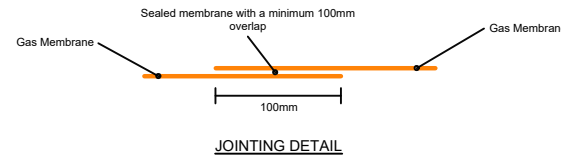
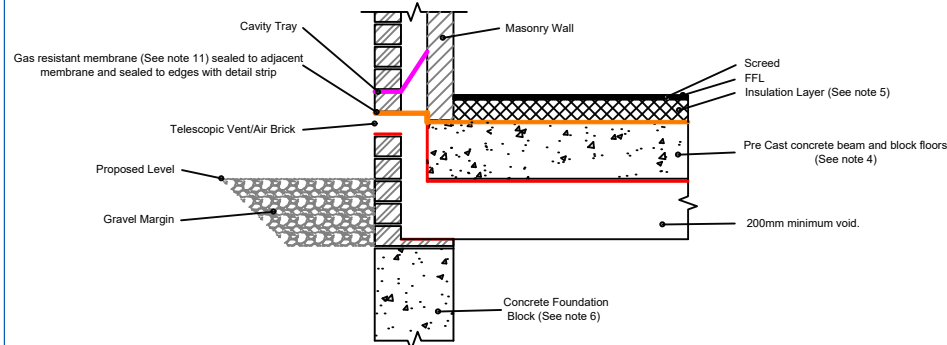
NOTES - SUBSOILS

The clays underlying the site should be classified for Shrinkage Potential in accordance with NHBC Chapter 4.2.

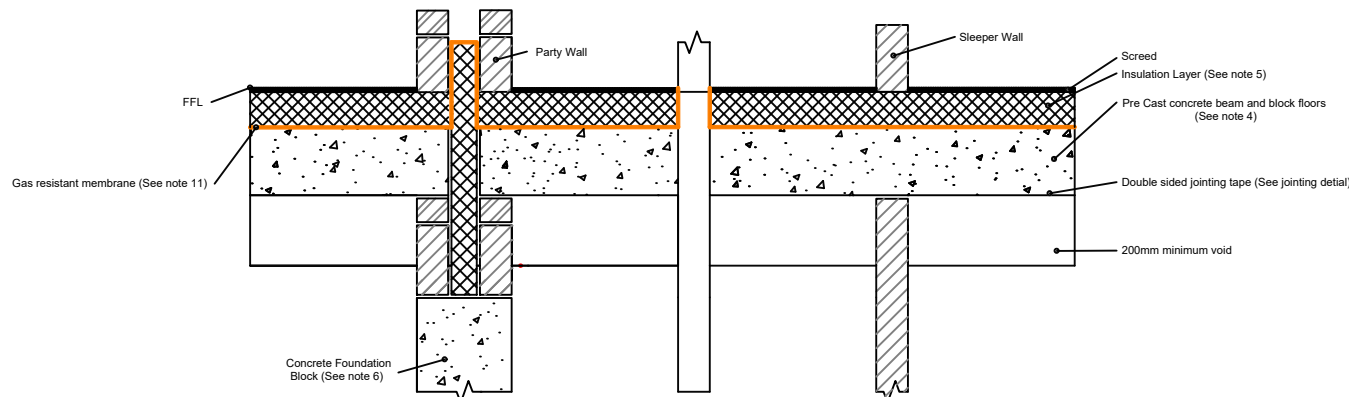
NOTES - GAS MEMBRANE DETAILS

It is proposed to install a Visqueen Gas Barrier within all plots at the site to satisfy the CS2 requirements. This membrane comprises of a multi-layer reinforced polyethylene gas barrier with a 20 micron aluminium foil. This membrane is multifunctional as it is designed to mitigate from carbon dioxide, methane and radon.

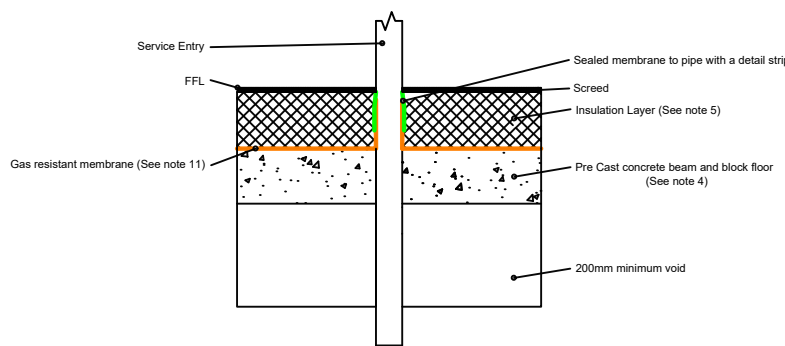
Property	Test method	Unit	Requirement	Result
Dimensions	EN 896-2	m	2 x 50	
Overall thickness including scrim mesh	EN 896-2	mm	± 5%	0.52
Mass	EN 896-2	g/m ²	0.95-0.98	0.66
Tensile strength - MD	EN 12381	N/50mm	MD	350
Tensile strength - CD	EN 12381	N/50mm	MD	350
Tensile elongation - MD	EN 12381	%	MD	20
Tensile elongation - CD	EN 12381	%	MD	31
Joint strength	EN 1317-3	N	MD	332
Water tightness 2kPa	EN 1925	-	Pass/Fail	Pass
Resistance to impact	EN 12081	mm	MD	50
Chemical	BS 2782	g	MD	283
Low temperature flexibility	EN 495-5	°C	MD	-40
Duration of sulphide ageing	EN 12381 and EN 1926	-	Pass/Fail	Pass
Duration chemical resistance	EN 1947	-	Pass/Fail	Pass
Resistance to tearing (ball shark) CD	EN 12381-1	N	MD	355
Resistance to tearing (ball shark) MD	EN 1310-1	N	MD	360
Resistance to static loading	EN 12730	kg	MD	20
Water vapour resistance	EN 1258	MkPa	MD	240000
Water vapour permeability	EN 1258	g/m ² /day	MD	0.000008
Water vapour resistance factor	EN 1258	µ	MD	100000000
Equivalent air layer thickness	EN 1258	SD in air	MD	43700
BS 8485:2015 + A1:2019 testing requirements				
Mass	EN 1918-2	g/m ²	Average ± 5%	0.62
Methane gas transmission rate	ISO 1918-1	mlm ² /day/m	MD	40.0
Tensile yield strength	BS EN ISO 12233	N	MD	190
Tensile yield strength MD	ASTM D4885-05	N/m	MD	12.5
Tensile yield strength CD	ASTM D4885-02	N/m	MD	73
Resistance to static loading	EN 12730	kg	-MD	20
Yield elongation CD	ASTM D4885-04	%	MD	19
Tear resistance - trouser method A - MD	BS 903 A1	N/m	MD	48.2
Tear resistance - trouser method B - CD	BS 903 B1	N/m	MD	48.8
Tear resistance - angle method B - MD	BS 903 A1	N	MD	53.5
Tear resistance - angle method B - CD	BS 903 B1	N	MD	80.6



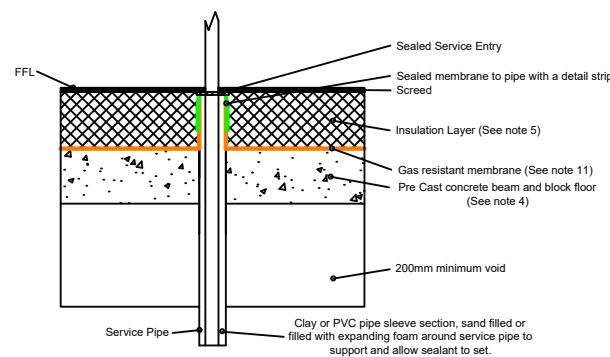
TYPICAL FOUNDATION DETAIL - FLOOR EDGE AT EXTERNAL WALL



FLOOR EDGE DETAIL AT PARTY WALL AND INTERNAL WALL



TYPICAL FOUNDATION DETAIL - SERVICE ENTRY



TYPICAL FOUNDATION DETAIL - SLEEVED SERVICE ENTRY

GROUNDTECH CONSULTING



CLIENT
MR JOHN HARDIE
PROJECT TITLE
LENCH ROAD, HAREHOLME
PLAN TITLE
TYPICAL GAS PRECAUTION DETAIL TO IN SITU SUSPENDED SLAB WITH POWERFLOAT FINISH FOR CS2 INCLUDING SERVICE ENTRY DETAILS

DATE
JANUARY 2024
SCALE
1:16 @ A1
PLAN NUMBER
GRO-20419-P07

Rev.	Details	Date

Status	
Preliminary	
Draft	
Issued	●
For Comment	
Approved	

Notes
● CDM HIGH RISK ASSESSMENT - FOR ALL RISKS REFER TO DESIGN RISK ASSESSMENT
● INSTALLATION, INSPECTION AND TESTING - A CIRIA C735 COMPLIANT VERIFICATION STRATEGY IS LIKELY TO BE REQUIRED, SUBJECT TO APPROVAL BY THE LOCAL AUTHORITY AND NHBC.

FOR GUIDANCE PURPOSES ONLY



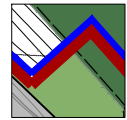
2000N

NORTH

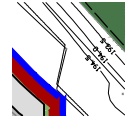
1960N

1920N

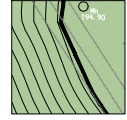
KEY:



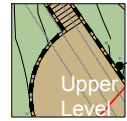
Red Edge Boundary



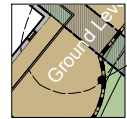
Land in ownership of the Applicant (hatched blue)



Existing retaining wall



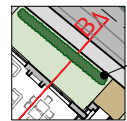
New retaining wall



Trees to be removed



New tree planting



New hedge



Drainage Easement (hatched grey)



Electric Vehicle Charging Points



PLANNING APPLICATION

Rev	Date	Revision Description	Drawn
B	08.10.21	Areas amended to plots 1, 2, 3 and 4 + Soft Landscaped Areas	DGL
A	06.09.21	Areas amended to plots 1, 2 and 3 + Soft Landscaped Areas	DGL

LENCH ROAD, RAWTENSTALL



Barn Meadow House
 Southfield Fold Farm
 Southfield
 Burnley
 Lancashire
 BB10 3RH
 Tel : 01282 601157
 Mbl : 07976 782876

Client JOHN HARDIE		Checked	
Project LENCH ROAD, RAWTENSTALL		Approved	
Drawing Title Site Layout		Drawn D.G.Lever	
Drawing No. 2000JHP/LRR/SL01		Scale 1:500 @ A3	
E-mail : darren.dgl@gmail.com		Drawn 12th Feb 2021	

Revision B	Drawn D.G.Lever	Checked
	Scale 1:500 @ A3	Approved
	Drawn 12th Feb 2021	
E-mail : darren.dgl@gmail.com		A3



APPENDIX 2 - General Requirements

1. Compliance with Legislation and Standards

The works are to be undertaken in compliance with all relevant British Standards, codes of practice, regulations, guidance and legislation. Whilst not an exhaustive list, works shall be in compliance with the latest revision of all relevant legislation, HSE Guidelines and good working practice including, but not be limited to, the following:

- *The Health and Safety at Work etc. Act 1974.*
- *Construction Health Safety and Welfare Regulations 1996.*
- *Health and Safety Executive 'Protection of Workers and the General Public during Redevelopment of Contaminated Land' HS (G) 66, HMSO 1991.*
- *The Construction, Design and Management Regulations 2007.*
- *The Control of Substances Hazardous to Health Regulations 2002 (COSHH Regulations).*
- *The Control of Asbestos Regulations, 2012.*

The Contractor is responsible for obtaining all necessary approvals, licences, consents and permits from regulatory bodies and third parties prior to commencement.

2. Licences, Permits and Consents

Any conditions associated planning permission should be addressed prior to carrying out the works.

It will be a requirement of the Contractor to obtain any of the necessary permits and undertake the appropriate notifications and assessments.

The Contractor should only expect approvals have been sought by others where explicitly provided to the Contractor or advised in writing.

Reuse of soils will need to be undertaken in accordance with the "Definition of Waste: Development Industry Code of Practice - Definition of Waste. Development Industry Code of Practice", Version 2 2011 i.e. in accordance with an approved Materials Management Plan and Qualified Person Declaration.

3. Health and Safety Requirements

The Principal Contractor must manage the risks in accordance with their legal requirements and all works are to be undertaken in compliance with all relevant regulations, guidance and legislation. A Construction Phase Health and Safety Plan (CPHASP) will be required to be submitted to the CDM co-ordinator, the Client and the LPA in advance of mobilisation to site. The CPHASP will be passed to the Site Manager who will implement all Health and Safety measures on site. The Site Manager will fully induct the Site Operatives prior to commencement of any works. The CPHASP will be kept as an open document and will be adapted as required to during the project. As a minimum this will include:

- *Welfare arrangements, storage and security.*
- *Air monitoring requirements (and action levels).*
- *Traffic management plan.*
- *Segregation of working areas and site welfare (and decontamination units if required).*
- *Site inductions, daily safety briefings and toolbox talks.*
- *Activity specific risk assessments.*
- *Method statement briefings.*
- *Daily inspection records.*
- *Permits to work.*

During the works it will be necessary to protect the health and safety of the site personnel.

General guidance on these matters is given in the Health and Safety Executive (HSE) document 'Protection of Workers and the General Public during the Redevelopment of Contaminated Land' HS (G) 66. In summary, the following measures are suggested to provide a minimum level of protection:

- *All ground workers should be issued with protective clothing (including high visibility clothing), hard hats, footwear and gloves, personnel instructed as to how it should be used.*
- *All personnel shall wear hard hats, high visibility clothing and protective footwear at all times.*
- *Ensure that everyone on site complies with the health and safety plan.*
- *Take reasonable steps to ensure that only authorised persons are allowed on site.*
- *Display, where they can be easily read, any notification that has been sent to the Health and Safety Executive.*
- *Hand washing and boot cleaning facilities shall be provided.*
- *No smoking except in designated areas.*
- *Good practices relating to personal hygiene shall be adopted.*
- *Prepare method statements for construction operations as required by the Principal Designer.*
- *Provide the CDM Co-ordinator with any other relevant information.*

Before site operations are commenced, the necessary COSHH Assessments, Method Statements and Health and Safety Plans should be completed, approved to the Principal Designers satisfaction and issued in accordance with the CDM Regulations.

The Construction Phase Health and Safety Plan (CPHASP) should pay particular attention to the following hazards which may be encountered:

- *Potentially hazardous or contaminated materials used or encountered on site.*
- *Deep excavations.*
- *The potential for ground gases and risks on confined spaced entry.*
- *Working in the vicinity of existing underground or overhead services.*
- *Working in confined spaces.*
- *Working on, or in the vicinity of highways.*
- *Working with materials which have the potential to contain asbestos and the risk of inhalation of asbestos fibres.*
- *Manual handling.*
- *The potential for fire.*
- *Working with electrical apparatus in the vicinity of mobile plant and the potential presence of water.*
- *Poor lighting.*
- *The potential for falling/slipping/tripping and sustaining injury.*
- *The possibility for biological agents to be present, including, but not limited to: psittacosis, leptospirosis (Weill's disease), tetanus, legionella, human waste.*
- *Working in the vicinity of voids and openings.*

The Contractor shall take all necessary safety precautions throughout the ground treatment operations and shall comply with the Health and Safety at Work Act 1974 or any subsequent re-enactment thereof.

The Contractor shall submit for approval all necessary method statements to the Client prior to commencing the works.

The Contractor shall provide details of emergency procedures. Emergency services shall be informed of the site operations prior to commencement.

All statutory records to be kept in the site manager's office and these may include (not an exhaustive list and note not all may be required):

- *ASB NNLW1 – Notification of non-licensed asbestos work if the work is deemed not be requiring a licence (if required).*
- *Appropriate licence with regards to CAR 1012 if the work is deemed to require a licence.*
- *HSE Notification F10.*
- *Construction Phase Health and Safety Plan.*
- *Method Statements and Risk Assessments; Environmental Permit deployment form and associated paperwork.*
- *Discharge Consents for disposal of groundwater.*
- *Competence records (including asbestos awareness training and face-fit test records).*
- *Utility records.*
- *Plant and machinery maintenance records.*
- *Duty of Care paperwork.*

4. Site Establishment and Security

Prior to the commencement of any works, the contractor, in conjunction with the Client and the Supervising Engineer, shall establish the boundaries of the site and working areas.

The Contractor shall make adequate provision to secure the site boundary and prevent unauthorised access onto the site during the course of the works.

Prior to the commencement of any works, the contractor, shall undertake a dilapidation survey of all adjacent features/construction including but not limited to boundary walls/ fences, adjacent footpath and road constructions etc. The survey is to be agreed with the Client or their representative prior to commencing any work on site.

The Contractor shall be responsible for all costs associated with rectification of damage to adjacent features/construction including but not limited to properties, boundary walls/ fences, adjacent footpath and road constructions etc. resulting from the demolition works.

The Contractor is to provide surveying capability as set out in this document facilitate the above. Prior to the completion of the works the Contractor is to discuss the continuation of the site security, including the fences, with the client and acceptable arrangements for continued security are to be agreed prior to the removal of the contractor's security provision.

5. Traffic Safety and Management

The Contractor shall comply in all respects with Chapter 8 of the Traffic Signs Manual for works on or affected the public highway and/or private roads forming the highway access to/from the site. The Enabling Works Contractor shall obtain all necessary consents from the Local Highway Authority for works on the public highway.

On-site access and haul routes should be provided and maintained by the Enabling Works Contractor in such a manner so as not to endanger either the user, those working in the vicinity of such accesses/haul routes and or the Works. Access to the site will be agreed with the Clients prior to commencement.

Suitable precautions shall be taken to prevent the spread of mud and debris on the public highways. Regular inspections of the public highway adjacent to the site shall be carried out. If deemed necessary by the Contractor, the Client or the Supervising Engineer, the highway shall be swept regularly to remove any mud, slurry or dust deposited by vehicles entering or departing the site. If the Supervising Engineer considers that significant amounts

of any detritus have been deposited on the public highway then operations shall be temporarily suspended until appropriate cleaning operations have been undertaken.

The Contractor is to co-operate with other Contractors if they are present during the works. The proposed works will generate a number of vehicle movements associated with the removal of soils and delivery to site of materials. Consideration should be given to the route and the timing of these vehicle movements, to minimise risk and disturbance to sensitive locations (such as schools, residential areas).

Risks associated with the transport of soils that are potentially containing contaminated, such as dust emission, should be appropriately managed.

6. Welfare Facilities

Site cabins and welfare facilities will be established at a location to be agreed with the Supervising Engineer.

The Contractor is deemed to have made provision and arrangements for all temporary utilities associated with the welfare facilities.

7. Working Hours

Noisy operations such as the use of hydraulic breakers shall be restricted to operating times as specified by the Client and by the Planning Permission. It is understood that these are 8:30 am to 5:30 pm, or other hours agreed with the Local Authority, Monday to Friday and 9.00 am to 1.00pm on Saturday. No working shall take place on Sunday or Bank Holidays.

Prior to commencement the Contractor is to make contact with the Local Authority to establish if any further restrictions apply.

8. Mobile Plant

Mobiles plant shall be operated by suitably trained and qualified operators experienced for each item of plant. When not in use all plant shall be locked to prevent all plant shall be locked to prevent unauthorised operation.

All traffic entering or working on site shall comply with a maximum 10 mph speed limit.

Fuelling of any plant shall be undertaken in a designated area and all above ground fuel storage tanks shall comply with the requirements of the Pollution Prevention Guidelines PPG2. Specifically, any storage tanks used should:

- *Be sited within an oil-tight secondary containment system such as an impermeable bund.*
- *The secondary containment must provide storage for at least 110% of the tanks maximum capacity.*
- *Be located within a secure area.*
- *All taps and valves should be fitted with a lock and kept locked shut when not in use. Maintenance of mobile plant should be undertaken in a designated area, unless absolutely necessary.*

Waste oil, hydraulic fluid etc. should not be tipped directly or discharged on to site. Such materials shall be stored separately, in a secure bunded area, for off-site disposal. Waste oil may be a special waste and disposal shall be undertaken by a registered carrier in accordance with the Duty of Care Regulations.

A spill kit shall be kept on site in an accessible place adjacent to the designated refuelling area.

9. Unexploded Ordnance (UXO)

The site is in an area which is considered to be at a low risk with regards to UXO.

10. Surveying

The Contractor shall provide full time surveying personnel and equipment to undertake the following activities and any other requirement for topographical information relating to the project that arises through the duration of the enabling works contract. The survey personnel and equipment should be capable of providing accurate levels and co-ordinates in relation to the national grid and topographical survey provided within 1 day of request.

The following key activities are covered by the requirements for surveying:

- *Confirmation of topographical survey on possession of the site, and setting out of the site boundary.*
- *Confirmation of positions of existing utilities and site features.*
- *The location of sub-structures removed.*
- *As built survey information.*

The Contractor is required to undertake all necessary topographical survey works to verify these levels before the commencement of the contract. Should the Contractor find any discrepancies on the drawings they are to refer the matter to the Engineer for verification before proceeding with the part of the works affected.

The Contractor shall undertake a topographical survey following completion of the enabling works.

All topographical surveys shall include levels at maximum 10m spacing and details of any features, changes in slope, structures, services and any other features of interest.

All of the above features shall be surveyed for line and level at the site boundary and marked on a plan. Levels shall be to Ordnance Datum and locations to National Grid. The survey shall be calibrated against existing site surveys and benchmarks in the vicinity of the site.

11. Testing

The Contractor shall be responsible for undertaking all testing necessary to satisfy the Supervising Engineer that the works have been carried out in accordance with, and comply with this Remedial Specification.

All soils and geo-environmental testing shall be carried out by a UKAS and MCERTS accredited laboratory, with accreditation for the specific analysis, to the approval of the Supervising Engineer.

12. Offsite Disposal

Materials for offsite disposal shall be sampled and analysed, by the contractor, at rates sufficient to allow the material to be adequately classified by assessment.

WAC testing should be undertaken on material exported from site to landfill, or other appropriately licensed facility. Material shall be hauled by a registered waste carrier in accordance with the requirements of the Duty of Care Regulations, 1991, Environmental Permitting (England and Wales) Regulations 2016 and where appropriate the Special Waste Regulations, 1996 and Hazardous Waste (England and Wales) Regulations 2005. A transfer note shall be completed, signed and retained by all parties involved. The transfer note shall state the volume of waste, the nature of the material and statement to the chemical composition. The waste transfer notes shall be kept by the Contractor for a period of at least 2 years.

13. Contamination

Contractors should be made aware of the possibility of encountering contaminants within soils or groundwater at the site through 'toolbox' talks.

Safe working procedures should be implemented in accordance with CIRIA 132 and good standards of personal hygiene should be observed and appropriate levels of PPE provided and utilised.

Eating, drinking and smoking should be strictly prohibited in the development site other than in designated mess areas.

14. The Control of Noise, Vibration and Dust Nuisance

The Contractor shall comply with the recommendations for practical measures to reduce noise and vibration set out in BS5228-1:2009 and BS5228-2:2009 and with any specific Principal Contractor requirements.

The Contractor shall take all reasonable measures to prevent dust nuisance from being generated by construction traffic, etc.

If necessary working methods will be altered in order to ensure that the level of noise generated from the works is within published tolerable limits.

The requirements of the LPA are to be sought and undertaken.

General

No fires shall be permitted on site.

Dust Mitigation

Appropriate measures shall be implemented at all times during the demolition and enabling works to minimise any dust emissions.

Any main temporary haul roads shall, where practical to do so, be constructed of crushed hardcore products. The haul roads shall be maintained for the duration of their use to minimise any build-up of loose spoil etc.

Traffic both entering and working on site shall obey a maximum speed limit of 10 mph. Wagons that are to be used for the haulage of any contaminated material from site shall be appropriately sealed or sheeted to prevent the release of fugitive dust.

Mobile water bowsers and sprayers shall be available on site at all times to water unpaved haul roads and working areas. The water spray may include chemical dust suppressants or wetting agents to improve dust control. An adequate supply of water shall be maintained on site at all times to allow for dust suppression activities to be carried out at short notice.

Where mobile water bowsers are not effective in suppressing dust then vapour masts shall be used. Such vapour masts shall be deployed at 20m centres on the downwind side of haul roads or excavations giving rise to significant dust or emissions of odour.

Air quality and dust monitoring stations will be set up and monitored by the Contractor to record the dust concentrations during the works.

With regards to stockpiles:

- *Stockpiles should be kept to a minimum to reduce 'wind whip' causing potentially hazardous material to be blown from the pile.*
- *Stockpiles should be placed on a suitable polythene membrane in a bunded area to prevent any cross contamination and care should be taken not to pierce the sheeting when placing the bulky elements of the material.*

- *Stockpiles should be dampened down or covered to prevent dust, whilst the final choice should be made by the Contractor based on site constraints, but the options include covering with plastic/polythene membrane, or by a layer of clean soil material.*
- *The drop distance from excavator bucket to stockpile will be kept as short as reasonably practicable to reduce dust.*

Odour

In general terms the excavation works are not considered likely to give rise to any significant odour problems. However; possible 'hotspots' of hydrocarbon contamination cannot be discounted and it is advised that odours are assessed by twice daily inspections of all Site boundaries.

If highly odorous materials are encountered, which may give rise to nuisance to neighbouring properties, appropriate vapour masts shall be deployed to provide suitable odour control. Any odorous materials shall be covered at the end of each working day and any stockpiles will be located away from any sensitive areas.

Plant and machinery shall be serviced regularly to ensure that exhaust fumes are compliant with best practice and relevant regulations.

Noise

The requirements of the Local Planning Authority and BS 5228: 1997 'Noise and vibration control on construction sites' shall be adhered to at all times.

All machinery shall be fitted with effective silencers and shall be serviced at regular intervals. No items of plant shall be operated with engine covers raised.

The location of any crushing plant shall take into consideration the location of neighbouring properties and other noise sensitive receptors and shall be located away from these areas and located adjacent to proposed stockpile locations where possible.

15. Water Quality Controls

The Contractor shall provide for such measures as may be necessary to ensure that water, whether groundwater, from precipitation or any other source does not accumulate in excavations or on sub-grades.

Adequate drainage sumps will be installed during works and cut off trenches/dewatering measures will be used as required to manage surface water run-off, to prevent any water from entering watercourses, either directly as surface water run-off, or indirectly via the surface water drainage systems; If materials escape, appropriate the Contractor is to undertake (at their cost) appropriate remedial action as soon as possible.

16. Utilities

Utility records are to be provided by the Client for information purposes within the enabling works documentation. However, the Contractor shall be responsible for liaison with the statutory utility providers to ensure all service records are current and correct. The Contractor is also responsible for the safe disconnection of existing utilities entering the site, except those which are to remain operational.

Prior to site work commencing, the position of all utilities indicated as on site or offsite but close to the site boundary shall be determined and clearly identified where on site. The locations should be confirmed on site by appropriate investigation, observations and survey. Any discrepancies between the anticipated positions and confirmed locations are to be reported to the Supervising Engineer.

All retained manholes should be located and clearly identified on site to prevent damage. The location, depth, diameter and invert level of each manhole and the size and depth of all stream connections shall be recorded.

Where drains or sewers are to be grubbed up the downstream ends should be plugged prior to commencement to prevent offsite systems becoming blocked or contaminated.

Where existing drains or sewers are to remain, CCTV surveys are to be provided by the contractor. These surveys must be undertaken on commencement prior to any physical work and on completion to demonstrate no damage has occurred.

Where damage has occurred, any remedial work must be agreed with the Supervising Engineer and relevant authority/owner prior to repairs commencing. The repair costs will be borne by the contractor.

All utilities on site that are to be retained through the works are to be positively located on site, reliance shall not be placed on existing records. Utilities are to be visibly marked and protected for the duration of the works. Appropriate methods are to be put in place to ensure all site staff working in the vicinity of retained utilities are fully briefed.

The Contractor is responsible for ensuring that all hydrant covers, stop tap boxes manhole covers and the like are raised or lowered to suit the finished levels associated with the proposed enabling works plateaus and future construction thicknesses.

Following the completion of the works, a survey plan of the location of terminated services is to be provided.

17. Damage to Property

All works are to be undertaken in accordance with the Party Wall etc Act 1996. The Contractor shall ensure that all precautions are taken in order to avoid any damage to existing property arising from the Works and shall be responsible for same in the event that any damage should arise from his failure to exercise due care.

Any adjacent structures, services and the like shall be inspected prior to commencement of the Works for evidence of existing defects and, if necessary, a dilapidation survey shall be carried out by the contractor, with the agreement of the Client and/or the Supervising Engineer, prior to works commencing on site. A re-inspection shall take place on completion of the Contract to verify that no damage or deterioration of the said structure, service or apparatus has occurred as a result of the Works. A schedule of the findings of this re-inspection shall be circulated to all parties concerned for their records.

The Contractor shall execute the works with care so as to avoid damage to existing structures and drains or other services to be retained.

All fences, trees, paths, shrubs, grassed areas and other surfaces required to be retained shall be protected by the Contractor from spillage and damage caused by site operations and upon completion of the works they shall be handed over in an undamaged and proper state to the satisfaction of the Engineer.

Refer to landscape architect drawings and specifications that define the areas that require protection. The Contractor shall not raise or lower the ground level beneath the spread of the branches of any tree to be retained without the approval of the Engineer.

18. Drawings and Supplied Information

Whilst efforts have been made to ensure that the information provided to the Contractor is correct and current, the Contractor is responsible for corroborating the existing information with the benefit of their site presence and to report any discrepancies encountered or anticipated to the Supervising Engineer immediately.

Where cutting and filling operations are to be carried out the Contractor is to undertake comparative assessments with the benefit of existing information, additional survey and their anticipated sequence of work to ensure



sufficient and suitable material is available to undertake the works as proposed. Any anticipated shortfall or surplus is to be report immediately.

19. Photographs

A detailed dilapidation survey shall be undertaken of the site and adjacent properties including joint site boundaries, in conjunction with adjacent land owners. Such survey shall include roads, footpaths, street lighting and road signs. A copy of the survey, including record photographs shall be provided to the Client within seven days of commencement of site works.

The Contractor is to provide on-site a digital camera and e-mail facilities to enable electronic transfer of site photographs and other information for the full duration of the contract. Progress photographs are to be taken at least weekly across all parts of the site for inclusion within the contractor's report. Photographs are to be made available to the Engineer/Client in electronic format should they be requested during the contract. Record photographs should be provided as part of the validation information



APPENDIX 3 - Remediation Options Appraisal

Introduction

This Options Appraisal has been undertaken in general accordance with Chapter 3 (Options Appraisal) of LCRM 'Model Procedures for Management of Land Contamination'. There are four main stages to this appraisal:

1. *Identifying Key Risk Drivers.*
2. *Identifying viable remediation options for each relevant pollutant linkage.*
3. *Carrying out a detailed evaluation of viable remediation options to identify the most appropriate option for each pollution linkage.*
4. *Producing a remediation strategy that reduces all relevant pollutant linkages to an acceptable level.*

Key Risk Drivers for Remedial Action

Groundtech Consulting have identified that the key risk drivers requiring remediation are:

- *Elevated concentrations of ground gases.*
- *Requirement of radon protective measures.*

The following sections of this report are intended to identify suitable and practical remedial techniques which can be applied in order to achieve a site which is suitable for the proposed residential development.

Grubbing up of the Made Ground and cut/fill balance exercise will remove, as far as practicable, all underground obstructions and create a development platform, which is geotechnically suitable for development.

Ground gas risks and potable water pipelines are not discussed in the Remediation Options Assessment as they are mitigated by measures outlined British Standards and by good practice.

Remediation Options and Evaluation of Feasibility

Preliminary Assessment of Remediation Options

Investigation and risk assessment has concluded that the requires remediation to reduce the risk to receptors to an acceptable level.

The objectives of the remediation are to remove one or more elements of each of the *source-pathway-receptor* linkages.

The initial screening process considers the available remedial techniques based on following key criteria:

- Effectiveness - the strategy must work within the context of the site and be effective in the removal of contamination linkages.
- Practicality situations - the strategy has to have been successfully used in similar on other sites and readily available within the UK market. Novel solutions or those still in the research stage are not considered here.
- Durability - the strategy needs to be durable and not reliant on ongoing maintenance to continue being effective.
- Relative Cost - the strategy must not be excessive cost.
- Relative Operational Time - the strategy should work in a feasible and realistic time scale.
- Sustainability - more sustainable options are preferred.

The table below summarises all of the accepted remedial techniques readily available and assess each against the six key parameters listed above.

In the first instance, the feasibility of each of the listed remedial option is assessed in terms of effectiveness at treating the contamination, which is broken down into; effective (Y), partially effective (P) or ineffective (N).

The techniques are then assessed in terms of relative cost ranging from negligible cost (£) through moderately expensive (££) to prohibitively expensive (£££+).

The timescale the remedial technique is operational has been generally assessed in units of weeks, months, years and decades. The longevity of the technique should be for the duration of the development to be effective.

The main reasons for rejection of a remedial option are generally the ongoing operational constraints, the cost and the ineffectiveness to mitigate the risk from all contaminants present. In some situations, several treatment options may be applicable and will therefore be considered as part of the appraisal.

Viable Remedial Options

As described above, certain technologies were rejected based on the above reasons. The short-list of options presented below represents those technologies which were not rejected at the pre-screening process and as such, are taken forward to the options appraisal process:

- *Watching brief during works*
- *Disposal of suitable material*

Cover System

A cover systems is a proven technology for mitigating the risk from numerous contaminants. The process comprises the placement of a cover system to form a barrier between the contaminated Made Ground and site users breaking the pollution linkage.

This option is technically simple and represents a low-cost strategy that can be implemented rapidly, subject to favourable site levels to accommodate the cover system.

The timescale for installing a barrier is relatively quick allowing for rapid completion of the remediation objectives and this remediation solution could be designed and implemented within a matter of weeks/months.

A cover system will be used a growing medium only for this project.

Disposal of Excess or Unsuitable Soils

Disposal involves the removal of contaminated soils and disposal at an appropriately licensed waste management facility or surplus material potentially to a recycling facility. The benefits of excavation and disposal are is short term implementation and the soils can be removed with a high degree of certainty by meeting proposed RTVs.

The cost of the method however can be significant depending on the classification and end disposal route, particularly in comparison to a cover system. The option will also take up valuable landfill space and present a significant carbon footprint in terms of vehicle movements.

Applicability of Remediation Options and Initial Assessment – Soils

Remedial Activity	Effective on Asbestos	Effective on Metals	Effective on PAHs	Relative Cost	Relative Operational Time	Comments (Practicality/Sustainability/Durability)	Feasibility
Containment - Cover System	Y	Y	Y	£	Weeks	<p><i>Not required – no contamination identified.</i></p> <p><i>Nominal 150mm suitably clean Topsoil required to be placed in gardens and soft landscaping to support root growth.</i></p>	Not Required
Excavation and Disposal	Y	Y	Y	££	Weeks to months	<p><i>Removal of unsuitable material and risk.</i></p>	Y – in conjunction with materials management if required.
Containment - hydraulic barriers	Y	Y	Y	£££	Months	<p><i>Not Required</i></p>	Not Required
Containment - in ground barriers	Y	Y	Y	£££	Months	<p><i>Not Required</i></p>	Not Required
Soil flushing	Y	Y	Y	£££	Months	<p><i>Not Required</i></p>	Not Required
Surface amendments	Y	Y	Y	£££	Months	<p><i>Not Required</i></p>	Not Required
Soil washing	Y	Y	Y	£££	Months	<p><i>Not Required</i></p>	Not Required
Hydraulic binders (such as cement)	Y	Y	Y	££	Weeks to months	<p><i>Not Required</i></p>	Not Required



Remedial Activity	Effective on Asbestos	Effective on Metals	Effective on PAHs	Relative Cost	Relative Operational Time	Comments (Practicality/Sustainability/Durability)	Feasibility
<i>Vitrification</i>	Y	Y	Y	£££	Months	<i>Not Required</i>	<i>Not Required</i>
<i>Incineration</i>	Y	Y	Y	£££	Months	<i>Not Required</i>	<i>Not Required</i>
<i>Thermal desorption</i>	Y	Y	Y	£££	Months	<i>Not Required</i>	<i>Not Required</i>



APPENDIX 4 - Remedial Target Values

Generic Assessment Criteria (GAC)								
Proposed End Use	Unit	Residential with Plant Uptake			Commercial			Source
SOM	%	1	2.5	6	1	2.5	6	
Arsenic	mg/kg	37	37	37	640	640	640	LQM S4ULs
Beryllium	mg/kg	1.7	1.7	1.7	12	12	12	LQM S4ULs
Boron (water soluble)	mg/kg	290	290	290	240000	240000	240000	LQM S4ULs
Cadmium	mg/kg	10	10	10	230	230	230	SGVs
Chromium (Total)	mg/kg	910	910	910	8600	8600	8600	LQM S4ULs
Chromium (VI)	mg/kg	21	21	21	49	49	49	DEFRA C4SLs
Copper	mg/kg	2400	2400	2400	68000	68000	68000	LQM S4ULs
Lead	mg/kg	200	200	200	2300	2300	2300	DEFRA C4SLs
Organic Mercury	mg/kg	1.2	1.2	1.2	26	26	26	LQM S4ULs
Nickel	mg/kg	130	130	130	980	980	980	LQM S4ULs
Selenium	mg/kg	350	350	350	13000	13000	13000	SGVs
Vanadium	mg/kg	410	410	410	9000	9000	9000	LQM S4ULs
Zinc	mg/kg	3700	3700	3700	730000	730000	730000	LQM S4ULs
Aliphatic EC 5 - 6	mg/kg	42	78	160	3200 (304) ^{sol}	5900 (558) ^{sol}	12000 (1150)	LQM S4ULs
Aliphatic EC 6 - 8	mg/kg	100	230	530	7800 (144) ^{sol}	17000 (322) ^{sol}	40000 (736) ^{sol}	LQM S4ULs
Aliphatic EC 8 - 10	mg/kg	27	65	150	2000 (78) ^{sol}	4800 (190) ^{sol}	11000 (451) ^{vap}	LQM S4ULs
Aliphatic EC 10 - 12	mg/kg	130 (48) ^{vap}	330 (118) ^{vap}	760 (283) ^{vap}	9700 (48) ^{sol}	23000 (118) ^{vap}	47000 (283) ^{vap}	LQM S4ULs
Aliphatic EC 12 - 16	mg/kg	1100 (24) ^{sol}	2400 (59) ^{sol}	4300 (142) ^{sol}	59000 (24) ^{sol}	82000 (59) ^{sol}	90000 (142) ^{sol}	LQM S4ULs
Aliphatic EC 16 - 35	mg/kg	65000 (8.48)	92000 (21) ^{f, sol}	110000 ^f	1600000 ^f	1700000 ^f	1800000 ^f	LQM S4ULs
Aliphatic EC 35 - 44	mg/kg	65000 (8.48)	92000 (21) ^{f, sol}	110000 ^f	1600000 ^f	1700000 ^f	1800000 ^f	LQM S4ULs
Aromatic EC 5 - 7	mg/kg	70	140	300	26000 (1220)	46000 (2260)	86000 (4710)	LQM S4ULs
Aromatic EC 7 - 8	mg/kg	130	290	660	56000 (869) ^{vap}	110000 (1920)	180000 (4360)	LQM S4ULs
Aromatic EC 8 - 10	mg/kg	34	83	190	3500 (613) ^{vap}	8100 (1500) ^{vap}	17000 (3580)	LQM S4ULs
Aromatic EC 10 - 12	mg/kg	74	180	380	16000 (364) ^{sol}	28000 (899) ^{sol}	34000 (2150)	LQM S4ULs
Aromatic EC 12 - 16	mg/kg	140	330	660	36000 (169) ^{sol}	37000	38000	LQM S4ULs
Aromatic EC 16 - 21	mg/kg	260 ^f	540 ^f	930 ^f	28000 ^f	28000 ^f	28000 ^f	LQM S4ULs
Aromatic EC 21 - 35	mg/kg	1100 ^f	1500 ^f	1700 ^f	28000 ^f	28000 ^f	28000 ^f	LQM S4ULs
Aromatic EC 35 - 44	mg/kg	1100 ^f	1500 ^f	1700 ^f	28000 ^f	28000 ^f	28000 ^f	LQM S4ULs
Benzene	mg/kg	0.33	0.33	0.33	95	95	95	SGVs
Toluene	mg/kg	610	610	610	4400	4400	4400	SGVs
Ethyl Benzene	mg/kg	350	350	350	2800	2800	2800	SGVs
Xylene - o	mg/kg	250	250	250	2600	2600	2600	SGVs
Xylene - m	mg/kg	240	240	240	3500	3500	3500	SGVs
Xylene - p	mg/kg	230	230	230	3200	3200	3200	SGVs
MTBE (methyl tert-butyl ether)	mg/kg	49	84	160	7900	13000	24000	CL:AIRE 2010
Acenaphthene	mg/kg	210	510	1100	84000 (57) ^{sol}	97000 (141) ^{sol}	100000	LQM SAULs
Acenaphthylene	mg/kg	170	420	920	83000 (86.1) ^{sol}	97000 (212) ^{sol}	100000	LQM S4ULs
Anthracene	mg/kg	2400	5400	11000	520000	540000	540000	LQM S4ULs
Benz(a)anthracene	mg/kg	7.2	11	13	170	170	180	LQM S4ULs
Benzo(a)pyrene	mg/kg	2.2	2.7	5*	35	35	77*	DEFRA C4SL*/LQM
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	44	44	45	LQM S4ULs
Benzo(ghi)perylene	mg/kg	320	340	350	3900	4000	4000	LQM S4ULs
Benzo(k)fluoranthene	mg/kg	77	93	100	1200	1200	1200	LQM S4ULs
Chrysene	mg/kg	15	22	27	350	350	350	LQM S4ULs
Dibenz(ah)anthracene	mg/kg	0.24	0.28	0.3	3.5	3.6	3.6	LQM S4ULs
Fluoranthene	mg/kg	280	560	890	23000	23000	23000	LQM S4ULs
Fluorene	mg/kg	170	400	860	63000 (30.9) ^{sol}	68000	71000	LQM S4ULs
Indeno(123-cd)pyrene	mg/kg	27	36	41	500	510	510	LQM S4ULs
Naphthalene	mg/kg	2.3 ^f	5.6 ^f	13 ^f	190 ^f (76.4) ^{sol}	460 ^f (183) ^{sol}	1100 ^f (432) ^{sol}	LQM S4ULs
Phenanthrene	mg/kg	95	220	440	22000	22000	23000	LQM S4ULs
Pyrene	mg/kg	620	1200	2000	54000	54000	54000	LQM S4ULs

Generic Assessment Criteria (GAC)								
Proposed End Use	Unit	Residential with Plant Uptake			Commercial			Source
SOM	%	1	2.5	6	1	2.5	6	
Phenol	mg/kg	420	420	420	3200	3200	3200	SGVs
Chlorophenols	mg/kg	0.87 ^g	2	4.5	3500	4000	4300	LQM S4ULs
Pentachlorophenol	mg/kg	0.22	0.52	1.2	400	400	400	LQM S4ULs
Carbon disulphide	mg/kg	0.14	0.29	0.62	11	22	47	LQM S4ULs
Hexachlorobutadiene	mg/kg	0.29	0.7	1.6	31	66	120	LQM S4ULs
1,1,1,2 Tetrachloroethane	mg/kg	1.6	3.4	7.5	270	550	1100	LQM S4ULs
1,1,1 Trichloroethane	mg/kg	8.8	18	39	660	1300	3000	LQM S4ULs
Trichloroethene	mg/kg	0.016	0.034	0.075	1.2	2.6	5.7	LQM S4ULs
Tetrachloromethane (Carbon Tetrachloride)	mg/kg	0.026	0.056	0.13	2.9	6.3	14	LQM S4ULs
1,2-Dichloroethane	mg/kg	0.0071	0.011	0.019	0.67	0.97	1.7	LQM S4ULs
Chloroethene (Vinyl chloride)	mg/kg	0.00064	0.00087	0.0014	0.059	0.077	0.12	LQM S4ULs
Trichloromethane (Chloroform)	mg/kg	0.91	1.7	3.4	99	170	350	LQM S4ULs
Tetrachloroethene	mg/kg	0.18	0.39	0.9	19	42	95	LQM S4ULs
Hexachlorobenzene	mg/kg	1.8 (0.2) ^{vap}	3.3 (0.5) ^{vap}	4.9	110 (0.2) ^{vap}	120	120	LQM S4ULs
Pentachlorobenzene	mg/kg	5.8	12	22	640 (43) ^{sol}	770 (107) ^{sol}	830	LQM S4ULs
1,2,4,5-Tetrachlorobenzene	mg/kg	0.33	0.77	1.6	42 (19.7) ^{sol}	72 (49.1) ^{sol}	96	LQM S4ULs
1,2,3,5-Tetrachlorobenzene	mg/kg	0.66	1.69	3.7	49 (39.4) ^{vap}	120 (98.1) ^{vap}	240 (235) ^{vap}	LQM S4ULs
1,2,3,4-Tetrachlorobenzene	mg/kg	15	36	78	1700 (122) ^{vap}	3080 (304) ^{vap}	4400 (728) ^{vap}	LQM S4ULs
1,3,5-Trichlorobenzene	mg/kg	0.33	0.81	1.9	23	55	130	LQM S4ULs
1,2,4-Trichlorobenzene	mg/kg	2.6	6.4	15	220	530	1300	LQM S4ULs
1,2,3-Trichlorobenzene	mg/kg	1.5	3.6	8.6	102	250	590	LQM S4ULs
1,4-dichlorobenzene	mg/kg	61 ^f	150 ^f	350 ^f	4400 ^f (224) ^{vap}	10000 ^f (540)	25000 ^f (1280)	LQM S4ULs
1,3-dichlorobenzene	mg/kg	0.4	1	2.3	30	73	170	LQM S4ULs
1,2-Dichlorobenzene	mg/kg	23	55	130	2000 (571) ^{sol}	4800 (1370) ^{sol}	11000 (3240)	LQM S4ULs
Chlorobenzene	mg/kg	0.46	1	2.4	56	130	290	LQM S4ULs
Gamma-Hexachlorocyclohexane	mg/kg	0.06	0.14	0.33	67	69	70	LQM S4ULs
Beta-Hexachlorocyclohexane	mg/kg	0.085	0.2	0.46	65	65	65	LQM S4ULs
Alpha -Hexachlorocyclohexane	mg/kg	0.23	0.55	1.2	170	180	180	LQM S4ULs
Beta -Endosulfan	mg/kg	7	17	39	6300 (0.00007)	7800 (0.0002)	8700	LQM S4ULs
Alpha-Endosulfan	mg/kg	7.4	18	41	5600 (0.003) ^{vap}	7400 (0.007) ^{vap}	8400 (0.016) ^{vap}	LQM S4ULs
Dichlorvos	mg/kg	0.032	0.066	0.14	140	140	140	LQM S4ULs
Atrazine	mg/kg	3.3	7.6	17.4	9300	9400	9400	LQM S4ULs
Dieldrin	mg/kg	0.97	2	3.5	170	170	170	LQM S4ULs
Aldrin	mg/kg	5.7	6.6	7.1	170	170	170	LQM S4ULs
HMX	mg/kg	5.7	13	26	110000	110000	110000	LQM S4ULs
2,4,6-Trinitrotoulene	mg/kg	1.6	3.7	8.1	1000	1000	1000	LQM S4ULs
RDX	mg/kg	120	250	540	210000	210000	210000	LQM S4ULs

^{sol} S4UL exceeds the solubility saturation limit (which is presented in brackets)

^{vap} S4ULS presented exceeds the vapour saturation limit, which is presented in brackets

^f For naphthalene, the S4UL is based on a comparison of inhalation exposure with the TDI_{inhal} for localised affects

^f S4UL based on comparison of inhalation exposure with inhalation TDI for localised effects

^{dir} S4ULs based on a threshold protective direct skin contact with phenol (guideline in brackets based on health effects following long term exposure provided for illustration only)



APPENDIX 5 – Gas Protection Membrane Specification

Visqueen Gas Barrier

Features and benefits

- BBA certified - third party accreditation
- Complies with NHBC Foundation's NF94 guidance for use in Type A membrane locations
- Complies with the methane gas transmission rate, mass per unit area and thickness requirements of BS 8485:2015 + A1:2019 - industry standard for methane and carbon dioxide protection
- Flexible - easy to detail and install on site
- Multi functional - also acts as a radon and damp proof membrane
- Dual jointing methods - lap joints can be taped or heat welded

Product description

Visqueen Gas Barrier is a multi-layer reinforced polyethylene gas barrier with a 20 micron aluminium foil. The barrier is coloured blue on the upper surface and silver on the reverse. The product is supplied in single wound rolls (not folded), 2m x 50m.

Approvals and standards

- Third party accreditation (BBA 13/5069)
- Complies with the methane gas transmission rate, mass per unit area and thickness requirements of BS 8485:2015 + A1:2019
- Suitable for all Characteristic Gas Situation (CS) ground gas regimes
- Complies with NHBC Foundation's NF94 guidance for use in Type A membrane locations
- Conforms to the specification requirements of NHBC Amber 1 and Amber 2 applications
- Conforms to the specification requirements of BR 211:2023
- CE Mark EN 13967:2017
- Quality Management System ISO 9001:2015
- Occupational Health and Safety System ISO 45001:2018
- Environmental Management System ISO 14001:2015

Usage

Visqueen Gas Barrier is suitable for use in all types of buildings to prevent the ingress of harmful levels of ground gases e.g. methane, carbon dioxide and radon.

The barrier can be positioned above or below reinforced cast in situ concrete floor slabs or above precast suspended segmental subfloors, e.g. beam and block floor.

The barrier can also be used as a high performance radon membrane and/or damp proof membrane.

Radon, carbon dioxide, and methane protection - NHBC NF94 guidance:

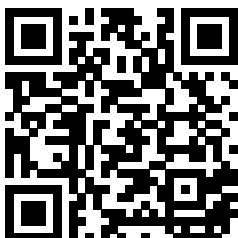
Visqueen Gas Barrier when installed with either taped or welded joints complies with NHBC Foundation's NF94 publication, Hazardous ground gas - an essential guide for housebuilders, in Type A membrane locations in precast suspended segmental subfloors and reinforced cast in situ concrete floor slabs (ground bearing, suspended or raft). For site or zone characteristic gas situations of CS4 and above, contact Visqueen Technical Services.

The product is not intended for use where there is a risk of hydrostatic pressure.

System components

- VisqueenPro Double Sided Jointing Tape, 50mm x 10m
- Visqueen Gas Resistant Foil Lap Tape, 75mm x 50m
- Visqueen GR Lap Tape, 150mm x 10m
- Visqueen Ultimate Top Hat Units
- Visqueen Preformed Units
- VisqueenPro Detailing Strip, 300mm x 10m, 500mm x 10m
- Visqueen TreadGUARD 300, 2m x 75m
- Visqueen TreadGUARD 1500, 1m x 2m

Find your local stockist





Visqueen Gas Barrier

Storage and handling

Visqueen Gas Barrier should be stored horizontally, under cover in its original packaging.

Care should be taken when handling the product in line with current manual handling regulations.

Preparation

Visqueen Gas Barrier should be installed on a smooth continuous surface e.g. grouted beam and block floor, a compacted blinding layer e.g. 50mm thick sand blinding, or smooth concrete blinding. The substrate should be free from irregularities such as voids or protrusions.

The barrier can be cut with a sharp retractable safety knife or robust scissors.

When installing the membrane in demanding site conditions, use Visqueen GR Lap Tape in place of Visqueen Gas Resistant Foil Lap Tape.

Installation

Visqueen Gas Barrier should be loose laid on the substrate with the blue side up so as to avoid sunlight glare.

The barrier should be clean and dry at the time of jointing. It should be overlapped by at least 150mm, bonded with Visqueen Pro Double Sided Jointing Tape and sealed with Visqueen Gas Resistant Foil Lap Tape. Alternatively lap joints can be heat welded to achieve an effective seal. The overlap in the barrier is typically 100mm and when hand welding, a 35mm weld is normally achieved. When hand welding, a roller must be used.

Airtight seals should be formed around all service entry points. Visqueen Preformed Top Hat Units are recommended for sealing service entry pipes. The base of the top hat and the upstand should be bonded using VisqueenPro Double Sided Jointing Tape and sealed with Visqueen Gas Resistant Foil Lap Tape. The upstand should be secured with the supplied jubilee clip. Alternatively VisqueenPro Detailing Strip can be used to seal service entry points. The upstand should be secured with a jubilee clip.

Forming an effective barrier to gases may give rise to complex three-dimensional detailing where, it is recommended Visqueen Preformed Units are used e.g. corners. Alternatively VisqueenPro Detailing Strip can be used to seal awkward junctions.

If the barrier is punctured or perforated a patch of the same material should be lapped at least 150mm beyond the limits of the puncture and bonded with Visqueen Pro Double Sided Jointing Tape and sealed with Visqueen Gas Resistant Foil Lap Tape. Alternatively a patch can be formed using VisqueenPro Detailing Strip and lapped at least 150mm beyond the extents of the puncture.

Long periods of exposure to ultraviolet light will reduce the effectiveness of the membrane. The membrane should be covered by a protective layer immediately after installation to prevent damage from following trades, ultraviolet light, etc. Care should be taken to ensure that the membrane is not punctured, stretched or displaced when applying a screed or final floor covering. A minimum thickness of 50mm screed is recommended. When reinforced concrete is to be laid over the barrier the wire reinforcements and spacers must be prevented from puncturing the barrier. Where there is a high risk of potential damage, the barrier should be covered with Visqueen TreadGuard protection, screed or other approved protection material before positioning the reinforcement.

Usable temperature range

It is recommended that Visqueen Gas Barrier and all associated system components should not be installed below 5°C.

Additional information

When used in accordance BS8485:2015 + A1:2019 a subfloor ventilation system or pressure relief maybe required

Where hydrocarbon or VOC contamination is present use Visqueen Ultimate HC Blok or Ultimate GeoSeal gas protection systems

To assist build sequencing, Visqueen Ultimate Gas DPC is available for gas protection through the wall constructions

For suspended beam and block floor detailing see GB-01

For internal and external corners Visqueen Ultimate Preformed Units should be used see PFU-553

To seal around steel columns use VisqueenPro Detailing Strip see GB-52

For additional detailing information, contact Visqueen Technical Services +44 (0) 333 202 6800

The information in this datasheet was correct at the time of publication. It is the user's responsibility to obtain the latest version of the datasheet as it is updated on a regular basis. The information contained in the latest datasheet supersedes all previously published editions.

Visqueen Gas Barrier

Property	Test method	Units	Compliance criteria	Result
Dimensions	EN 1848-2	m		2 x 50
Overall thickness including scrim mesh	EN 1849-2	mm	+/-10%	0.52
Mass	EN 1849-2	g/m ²	-0%/+5%	400
Tensile strength - MD	EN 12311	N/50mm	MLV	350
Tensile strength - CD	EN 12311	N/50mm	MLV	350
Tensile elongation - MD	EN 12311	%	MLV	20
Tensile elongation - CD	EN 12311	%	MLV	21
Joint strength	EN 12317-2	N	MLV	332
Watertightness 2kPa	EN 1928	-	Pass/Fail	Pass
Resistance to impact	EN 12691	mm	MDV	150
Dart impact	BS 2782	g	MDV	731
Low temperature flexibility	EN 495-5	°C	MDV	-40
Durability against ageing	EN 1296 and EN 1928	-	Pass/Fail	Pass
Durability chemical resistance	EN 1847	-	Pass/Fail	Pass
Resistance to tearing (nail shank) CD	EN 12310-1	N	MDV	358
Resistance to tearing (nail shank) MD	EN 12310-1	N	MDV	368
Resistance to static loading	EN 12730	kg	MLV	20
Water vapour resistance	EN 1931	MNs/g	MDV	240,000
Water vapour permeability	EN 1931	g/m ² /d	MDV	0.0008658
Water vapour resistance factor	EN 1931	μ	MDV	120,000,000
Equivalent air layer thickness	EN 1931	SD in m	MDV	47,700
BS 8485:2015 + A1:2019 testing requirements				
Mass	EN 1849-2	g/m ²	Average >370	400
Methane gas transmission rate	ISO 15105-1	ml/m ² /day/atm	MDV	<0.15
Puncture CBR	BS EN ISO 12236	N	MDV	1114
Tensiles yield strength MD	ASTM D4885-01	kN/m	MDV	12.5
Tensiles yield strength CD	ASTM D4885-02	kN/m	MDV	7.3
Resistance to static loading	EN 12730	kg	>MLV	20
Yield elongation CD	ASTM D4885-04	%	MDV	19
Tear resistance - trouser method A - MD	BS ISO 34-1	kN/m	MDV	48.2
Tear resistance - trouser method A - CD	BS ISO 34-1	kN/m	MDV	44.8
Tear resistance - angle method B - MD	BS ISO 34-1	N	MDV	53.5
Tear resistance - angle method B - CD	BS ISO 34-1	N	MDV	60.6

Health and safety information

Refer to the Visqueen Gas Barrier safety datasheet (SDS).

Visqueen Gas Barrier

About Visqueen

The Visqueen name has long been recognised as one of the leading manufacturers of high quality advanced membrane technologies and design based solutions by specifiers, distributors, builders merchants and contractors throughout the UK and Europe.

For further guidance on the Visqueen services shown below, please refer to the relevant section of the Visqueen website (www.visqueen.com) or contact Visqueen Technical Services on +44 (0) 333 202 6800 or enquiries@visqueen.com

Complete Range, Complete Solution



Structural
Waterproofing



Gas
Protection



Damp Proof
Membrane



Tapes



Damp Proof
Course



Stormwater



Vapour
Control

Visqueen Technical Support

Visqueen combine an extensive product portfolio with industry leading levels of service and support which includes guidance over the phone, bespoke CAD drawings to help with complex detailing, electronic NBS specifications and access to a dedicated team of highly knowledgeable and experienced field based Technical Support Managers.

Visqueen Technical Support is available to all our customers including architects, specifiers, distributors, builders merchants, contractors and end users. All of our technical team have been awarded the industry recognised qualification Certificated Surveyor in Structural Waterproofing (CSSW).

Visqueen CPD Seminars

The Visqueen Continuing Professional Development (CPD) Seminars provide up-to-date information on changes within Building Regulations/Building Standards and nationally recognised industry guidance affecting damp proofing, water vapour control, hazardous ground gas protection and below ground structural waterproofing.

The one hour seminars have been produced for design specialists within the construction sector and are delivered by our team of Technical Support Managers.

Visqueen PI designs and special projects

From initial design to the completed project, Visqueen are with you every step of the way. Whether it be hazardous ground gas protection and/or below ground waterproofing protection employing barrier, structurally integral or drained systems, Visqueen can offer professional indemnity (PI) insurance for bespoke Visqueen design solutions.

Visqueen Technical Support Managers work with all stakeholders to provide cost effective Visqueen solutions offering complete peace of mind throughout the construction phase and beyond.

Visqueen Training Academy

Based at our manufacturing facility in Derbyshire, the Visqueen Training Academy is available to support Visqueen customers throughout the UK by providing a wide range of both theory and practical skills related training.

Courses include one day product awareness training for our distributors and builders merchants to help them in their day-to-day jobs, through to intensive three day courses giving detailed hands-on training in the practical skills required for safe and robust product installation.



APPENDIX 6 - Gas Protection Validation Record

Gas Protection Validation Record

Job No: GRO-20419
Client: MR JOHN HARDIE
Site Name: LENCH ROAD, HAREHOLME
Plot Number:

Drawing Ref: PCL(2018)-SD-SUB/009

Property Type			
Det	Semi	Town House	Apt
Attached Garage		Commercial	

Gas Protection Type Passive

Floor Type Suspended

Ventilated Sub Floor	✓/*	Inspection Date	Inspected By:	photos:	Notes
Void Former? Heave?					1
Void Height					2
Pipe Size & Spacing?					4
External Wall Air Bricks					5
Internal Sleeper Wall Vents					6

Gas Barrier	✓/*	Inspection Date	Inspected By:	photos:	Notes
Membrane Type					8
Extent of Coverage					9
Underside of membrane					10
Slab/membrane condition					11
Laps and joints					12
Damp-proof course					13
Service entries and seals					14
Cavity inspection					15

This plot has inspection



APPENDIX 7 - Limitations



Limitations

This contract was completed by Groundtech Consulting on the basis of a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with due skill and care, taking into consideration the project brief provided, project objectives, agreed scope of works, prevailing site conditions and budget allocation.

Other than that defined in the paragraph above, Groundtech Consulting provides no other accountability or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted industry practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Groundtech Consulting. A third party who relies on this report, does so at their own and sole risk and no liability to such parties is provided by Groundtech Consulting.

It is the understanding of Groundtech Consulting that this report is to be used for the intended purpose as set out in the introduction. The purpose was instrumental in determining the scope and level of the services provided. Should the purpose of the report or the proposed end use of the site change, this report will no longer be directly applicable, and its validity readdressed. No reliance upon the report in the revised situation should be assumed by the client without the permission of Groundtech Consulting.

The report was written in 2018, later changes in legislation, statutory requirements and industry best practices have not been considered and this should be allowed for. Ground conditions can also change and should be investigated if there is any significant delay in acting on the findings of this report. The period of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions in this report should not be relied upon in the future without the written confirmation from Groundtech Consulting that it is safe to do so.

The observations and conclusions outlined in this report are based exclusively on the services that were provided as set out in the agreement between the client and Groundtech Consulting.

Groundtech Consulting are not liable for the existence of any condition, the discovery of which would require additional investigation outside the agreed scope of works or core competency. The services provided are based upon Groundtech Consulting observations of existing physical conditions at the site gained from site reconnaissance together with interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and Groundtech Consulting assume the information to be correct.

No responsibility can be accepted for errors for third party information presented in this report. Groundtech Consulting were not authorised to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the services. Groundtech Consulting are not liable for any inaccurate information, misrepresentation of data or conclusions, which may inform the scope of investigation undertaken by Groundtech Consulting and forms the contract with the client.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable due to its heterogeneous properties and as investigation exploratory locations only allow examination of the ground at discrete



locations. The potential exists for ground conditions to be encountered which are different to those considered in this report, particularly between exploratory holes. The extent of the limited area depends on the soil and groundwater conditions, together with other constraints such as the position of any existing structures and underground utilities. Geo-Environmental testing was carried out for a limited number of parameters [as stipulated in the contract] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The groundwater level often has not had time to reach equilibrium and a monitoring period is required. Furthermore, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawings provided in this report are not meant to be an accurate base plan, but are preliminary and used to present the general relative locations of features on, and surrounding, the site.

